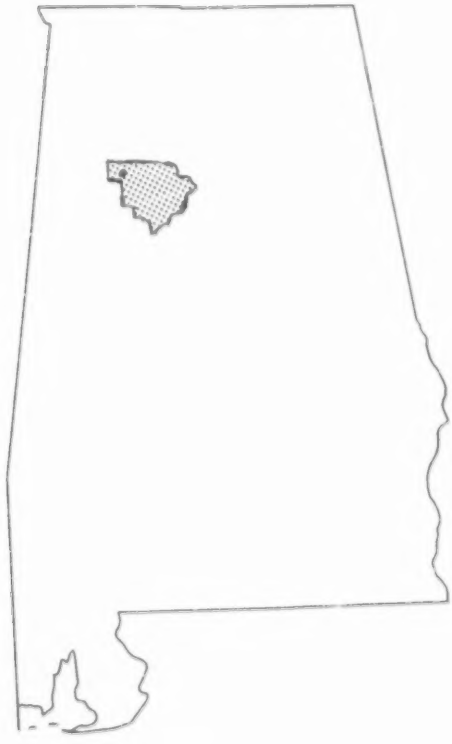
010204

FLOOD INSURANCE STUDY

NEWARK PUBLIC LIBRARY
JAN 7 1981
U. S. GOVT. PUBS.
DEPOSITORY 376

CITY OF CARBON HILL, ALABAMA
WALKER COUNTY



SEPTEMBER 16, 1980

federal emergency management agency
federal insurance administration

COMMUNITY NUMBER - 010204

FEMI-209.

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
1.1	Purpose of Study	1
1.2	Authority and Acknowledgments	1
1.3	Coordination	1
2.0	AREA STUDIED	2
2.1	Scope of Study	2
2.2	Community Description	2
2.3	Principal Flood Problems	4
2.4	Flood Protection Measures	4
3.0	ENGINEERING METHODS	4
3.1	Hydrologic Analyses	4
3.2	Hydraulic Analyses	6
4.0	FLOOD PLAIN MANAGEMENT APPLICATIONS	6
4.1	Flood Boundaries	7
4.2	Floodways	7
5.0	INSURANCE APPLICATION	10
5.1	Reach Determinations	10
5.2	Flood Hazard Factors	10
5.3	Flood Insurance Zones	10
5.4	Flood Insurance Rate Map Description	11

TABLE OF CONTENTS - continued

		Page
6.0	OTHER STUDIES	11
7.0	LOCATION OF DATA	11
8.0	BIBLIOGRAPHY AND REFERENCES	13

FIGURES

Figure 1 - Vicinity Map	3
Figure 2 - Floodway Schematic	9

TABLES

Table 1 - Summary of Discharges	5
Table 2 - Floodway Data	8
Table 3 - Flood Insurance Zone Data	12

EXHIBITS

Exhibit 1 - Flood Profiles	
Lost Creek	Panels 01P - 03P
Exhibit 2 - Flood Boundary and Floodway Map Index	
Exhibit 3 - Flood Boundary and Floodway Map	

PUBLISHED SEPARATELY:

Flood Insurance Rate Map

FLOOD INSURANCE STUDY
CITY OF CARBON HILL, ALABAMA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Carbon Hill, Walker County, Alabama and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the City of Carbon Hill to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 24 CFR, 1910.1 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Law Engineering Testing Company for the Federal Insurance Administration, under Contract No. H-4636. This study was completed in August, 1979.

1.3 Coordination

Streams requiring detailed study were identified at a meeting attended by representatives of Law Engineering Testing Company, FIA, and representatives of the City of Carbon Hill in February 1978.

On April 11, 1980, the results of the study were reviewed at the final meeting attended by representatives of Law Engineering Testing Company, FIA, and community officials. The study was acceptable to the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Carbon Hill. The area of study is shown on the Vicinity Map (Figure 1).

The limits of detailed and approximate studies in Carbon Hill were determined by FIA with community and study contractor consultation at the meeting in February 1978.

Floods caused by overflow of Lost Creek from the downstream corporate limits of Carbon Hill to its confluence with Allen Creek were studied in detail. Flooding on the remainder of Lost Creek and Allen Creek within the corporate limits was studied by approximate methods.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through 1983.

2.2 Community Description

The City of Carbon Hill is located in the northwest section of Walker County, Alabama. It is approximately 15 miles northwest of Jasper, Alabama on U.S. Highway 78. The Carbon Hill Planning Area includes the area within the corporate limits and one mile beyond; it contains approximately 17.3 square miles. The population as of 1971 was 2700 (Reference 1).

The drainage flow for the Carbon Hill Planning Area is in a southeasterly direction. Small creeks flow into the Lost Creek drainage basin which eventually drains into the Black Warrior River.

Approximately 88 percent of the land within the planning area is undeveloped. Of the remaining developed land, 37 percent is residential, 34 percent is resource production (mainly strip mines) and 21 percent is transportation, communication and utility related. The remaining 8 percent of the developed land consists of recreational, industrial, commercial and public lands.

The major industries in Carbon Hill include Cobb Coal Company and Reltoc Manufacturing Company, Inc. (Reference 2).

The City of Carbon Hill is served by U.S. Highway 78, and County Roads 11 and 63. Also, the rail system (St. Louis-San Francisco) which runs along U.S. 78 provides means of transporting industrial goods into and out of the city.

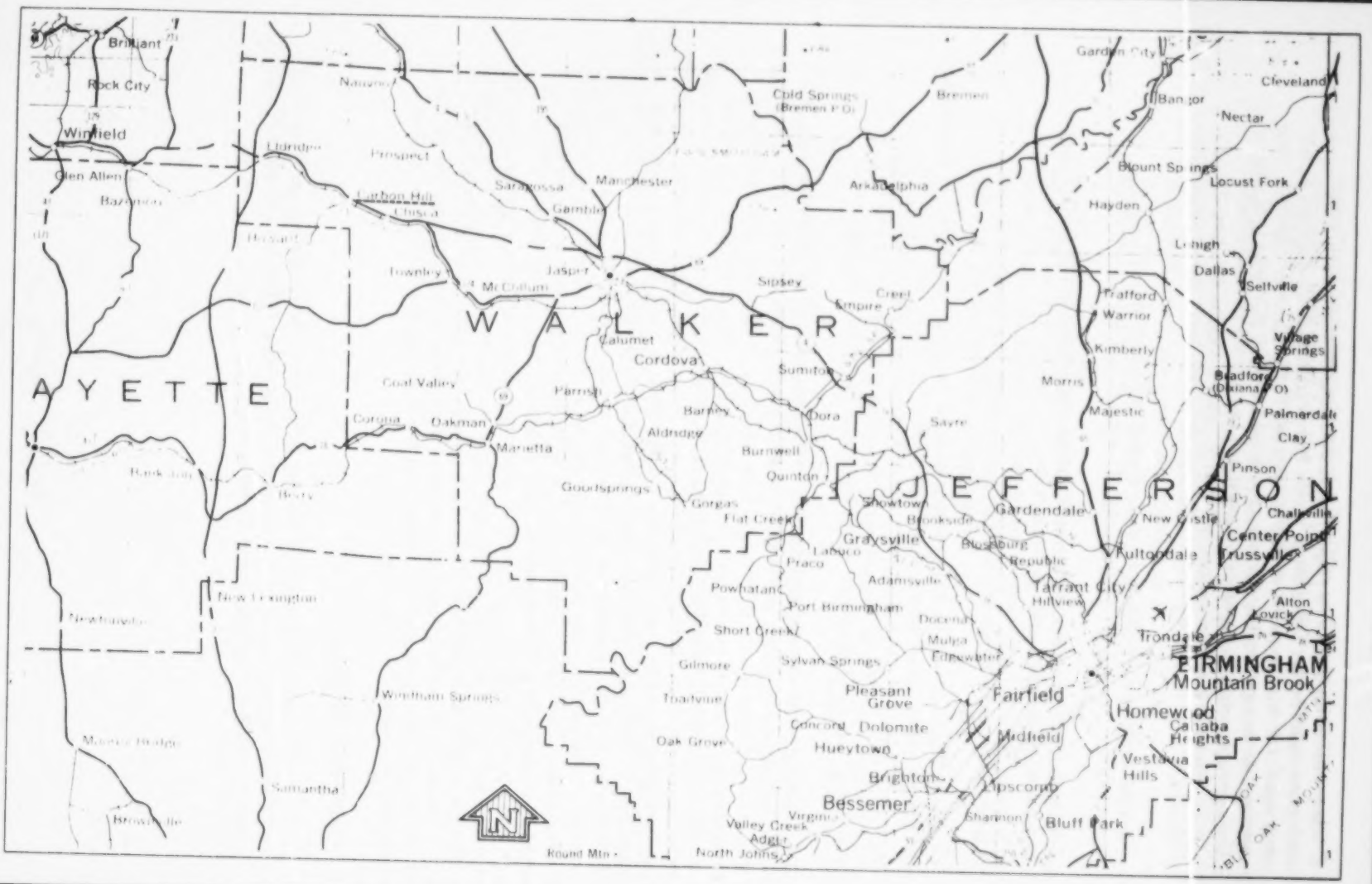


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF CARBON HILL, AL
(WALKER CO.)

APPROXIMATE SCALE

8 0 8 16 24 MILES

VICINITY MAP

Carbon Hill is located in a region of temperate climate with mild winters and warm summers. The annual mean temperature is 61 degrees F, 45 degrees F for winter months and 76 degrees F for summer months. The average annual rainfall is 53 inches and snowfall in the area is negligible. The average relative humidity is 70 percent.

2.3 Principal Flood Problems

The past history of flooding on Lost Creek indicates that flooding may occur during any season of the year.

The area located adjacent to the U.S. Fish Hatchery on Hickory Street has been subject to flooding.

2.4 Flood Protection Measures

Appreciable flood protection measures have not been employed in the City of Carbon Hill.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, and 500-year period (recurrence intervals), have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50 year period is about 40 percent (four in 10), and for any 90 year period, the risk increases to about 60 percent (six in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail in the community.

Equations have been developed by Olin and Bingham (Reference 3) for estimating peak flows for the 10-, 50- and 100-year floods on natural streams in Alabama. These flows were used on streams with drainage areas of 1 to 15 square miles. Flood frequency relationships developed by Hains (Reference 4) were used for the stream when the drainage area was between 25 and 800 square miles. When the watershed was between 15 and 25 square miles, peak flows were computed by combining the two methods using a weighted average based on drainage area. The 500-year flows were determined by extrapolating the 10-, 50-, and 100-year peak flows using a least squares fit of a log-normal distribution.

The Sauer Method (Reference 5) was used to adjust the natural flows to account for the effects of urbanization. This method relates to peak discharge for any return interval to the percentage of impervious area in the watershed and the average rainfall intensity ratio of the 10-, 50-, and 100-year storms to the 2-year storm.

Land use for each watershed was determined from aerial photos (Reference 6), USGS quadrangles (Reference 7) and field inspection. The percent impervious area for any given land use was obtained from the Soil Conservation Service, Technical Release No. 55 (Reference 8).

The peak discharge-drainage area relationships for the selected recurrence intervals are presented in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
LOST CREEK					
At Confluence of Cranford Creek	21.4	2,600	4,250	5,050	6,600
At downstream corporate limits	28.2	2,900	4,800	5,800	7,550

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in the City of Carbon Hill were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the flood sources.

Cross sections for the backwater analyses of Lost Creek were obtained from aerial photographs taken in March 1978 at a negative scale of 1.0 inch equals 800 feet. The below-water sections were obtained by field measurement. All bridges, dams, and culverts were field checked to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 3).

Channel roughness factors (Manning's "n") used in the hydraulic computations, were chosen by engineering judgement and based on field observation of the streams and flood plain areas. Roughness values used for Lost Creek averaged 0.05 and 0.15 for the channel and overbank areas, respectively.

Water-surface elevations for floods of the selected recurrence intervals were computed through used of the Corps of Engineers HEC-2 Step-Backwater Computer Program (Reference 9). Flood Profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. The starting water-surface elevations for Lost Creek were calculated using the slope-area method. All elevations are referenced from the National Geodetic Vertical Datum of 1929, (NGVD) formerly referred to as Sea Level Datum of 1929; elevation reference marks used in this study are shown and described on the maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and the 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:6000 with a contour interval of 4 feet (Reference 10). In cases where the 100- and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

For the streams studied by approximate methods, the boundary of the 100-year flood was developed from normal depth calculations, the topographic maps referenced above, and information provided by residents along the study streams.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 3). Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodway presented in this study was computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH[2] (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Lost Creek								
A	600	1,606	6,154	0.9	402.1	402.1	403.0	0.9
B	1,800	1,723	5,564	1.0	402.9	402.9	403.7	0.8
C	3,325	1340/700	2,149	2.7	404.5	404.5	405.5	1.0
D	6,425	1044/665[3]	3,541	1.4	407.7	407.7	408.7	1.0
E	6,775	1439/1050	7,197	0.7	408.0	408.0	409.0	1.0
F	8,825	660	2,691	1.9	409.1	409.1	409.9	0.8
G	10,025	86	920	5.5	410.7	410.7	411.6	0.9
H	11,075	66	682	7.4	413.1	413.1	413.8	0.7
I	11,450	95	968	5.2	414.2	414.2	415.2	1.0
J	12,350	119	1,293	3.9	415.6	415.6	416.6	1.0

[1] Feet upstream of corporate limits.
[2] Total width/width within corporate limits.
[3] Width does not include islands.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

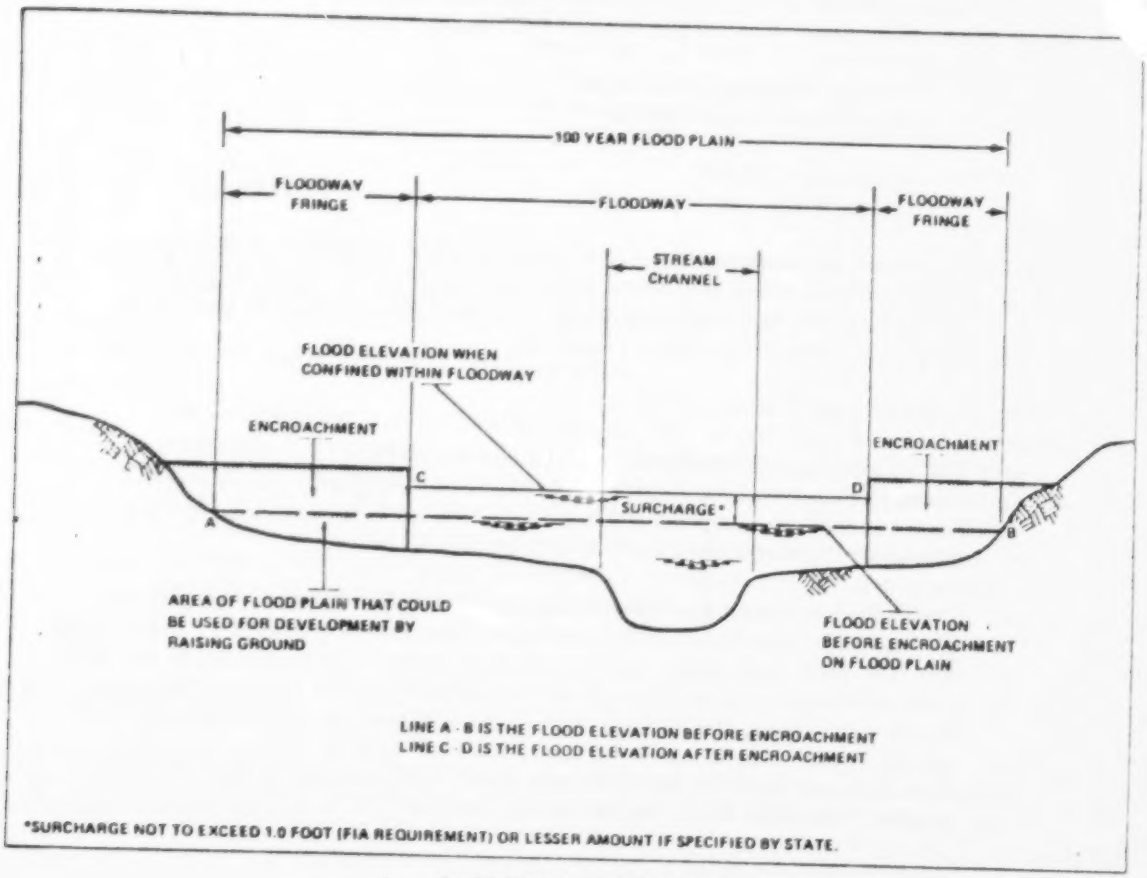
CITY OF CARBON HILL, AL
(WALKER CO.)

FLOODWAY DATA

LOST CREEK

As shown on the Flood Boundary and Floodway Map (Exhibit 3), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown. Due to the orientation of cross sections B and C, it was necessary to extend the floodway widths at these points in order to maintain continuity.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
A
B
SURCHARGE*
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC

Figure 2

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each significant flooding source affecting the City of Carbon Hill. .

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot

Two reaches meeting the above criteria were required for the flooding sources of the City of Carbon hill. The location of these reaches are shown on the Flood Profiles (Exhibit 1) and summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors (FHFs)

The Flood Hazard Factor is used to correlate flood information with insurance rate tables. Correlations between property damages from floods and their assigned FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between the water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, the accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the City of Carbon Hill was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zones A4, A5	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; or areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevation for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Carbon Hill is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

In 1975 the USGS conducted a study of the flood prone areas in Carbon Hill. To date, there have been no other studies performed. The data presented here is authoritative for the purposes of the Flood insurance Program.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3]
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Lost Creek							
Reach 1	0002	-1.83	-0.53	+0.84	020	A4	Varies
Reach 2	0002	-2.60	-0.78	+1.32	025	A5	Varies

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT-SEE MAP

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF CARBON HILL, AL
(WALKER CO.)

FLOOD INSURANCE ZONE DATA

LOST CREEK

be obtained by contacting the office of the Federal Emergency Management Agency, Insurance and Mitigation Division, 1375 Peachtree Street, N.E., Suite 778, Atlanta, Georgia 30309.

8.0 BIBLIOGRAPHY AND REFERENCES

1. Birmingham Regional Planning Commission, Comprehensive Plan, Carbon Hill, Alabama, June 1974.

2. Alabama Development Office, 1978 - 1979 Alabama Directory of Mining and Manufacturing, Montgomery, Alabama, October 1978.

3. Olin, D.A. and Bingham, R.H., Flood Frequency of Small Streams in Alabama, Alabama Highway Research, Project No. 930-087, August 1977.

4. Hains, C.F., Floods in Alabama - Magnitude and Frequency, U.S. Geological Survey/Alabama Highway Department, 1973.

5. Golden, H.G., Preliminary Flood-Frequency Relationships for Urban Streams, Metropolitan Atlanta, Georgia U.S. Geological Survey, August 1977.

6. Aerial Photography, Jack Berry and Associates, Peachtree City, Georgia 1978.

7. United States Geological Survey, Topographic Maps, 7.5 Minute Series: Carbon Hill, Alabama, 1967; Howard, ALabama, 1967.

8. U.S. Department of Agriculture, Soil Conservation Service, Technical Release No. 55 - Urban Hydrology for Small Watersheds, January1975.

9. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water- Surface Profiles Users Manual, Davis, California, November 1976.

10. Topographic Manuscript Produced from aerial photos, Jack Berry and Associates, Peachtree City, Georgia, 1979.

U.S. Army Corps of Engineers, Hydrologic Engineering Center, Application of the HEC-2 Bridge Routines, June 1974.

U.S. Army Corps of Engineers, Hydrologic Engineering Center, Floodway Determination Using Computer Program HEC-2, May 1974.

U.S. Department of Transportation, Federal Highway Administration, Hydraulics of Bridge Waterways, 1970.

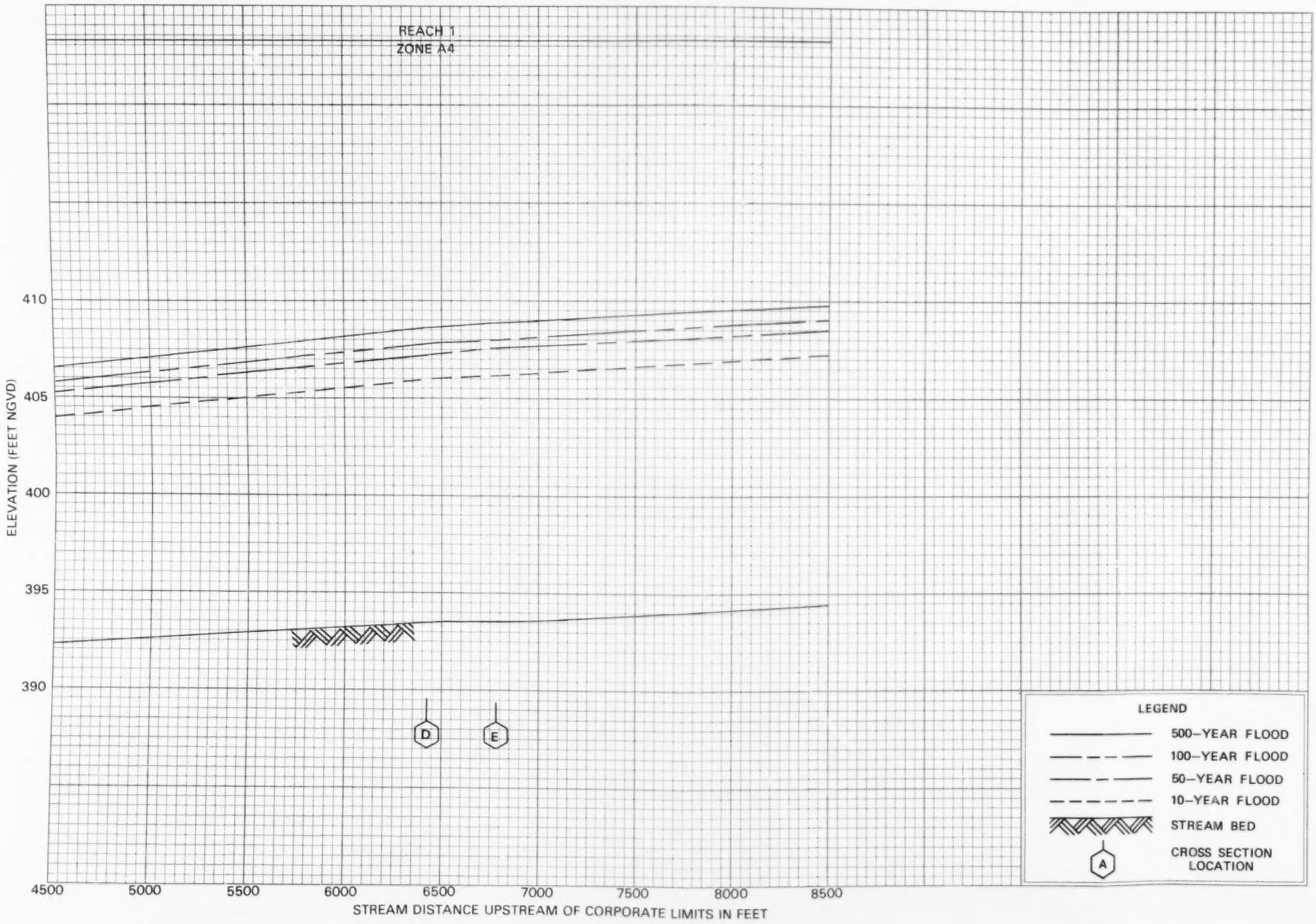
FLOOD PROFILES

LOST CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF CARBON HILL, AL
(WALKER CO.)

01P



FLOOD PROFILES

LOST CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF CARBON HILL, AL
(WALKER CO.)

02P

best copy available

FLOOD PROFILES

LOST CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF CARBON HILL, AL
(WALKER CO.)

03P